

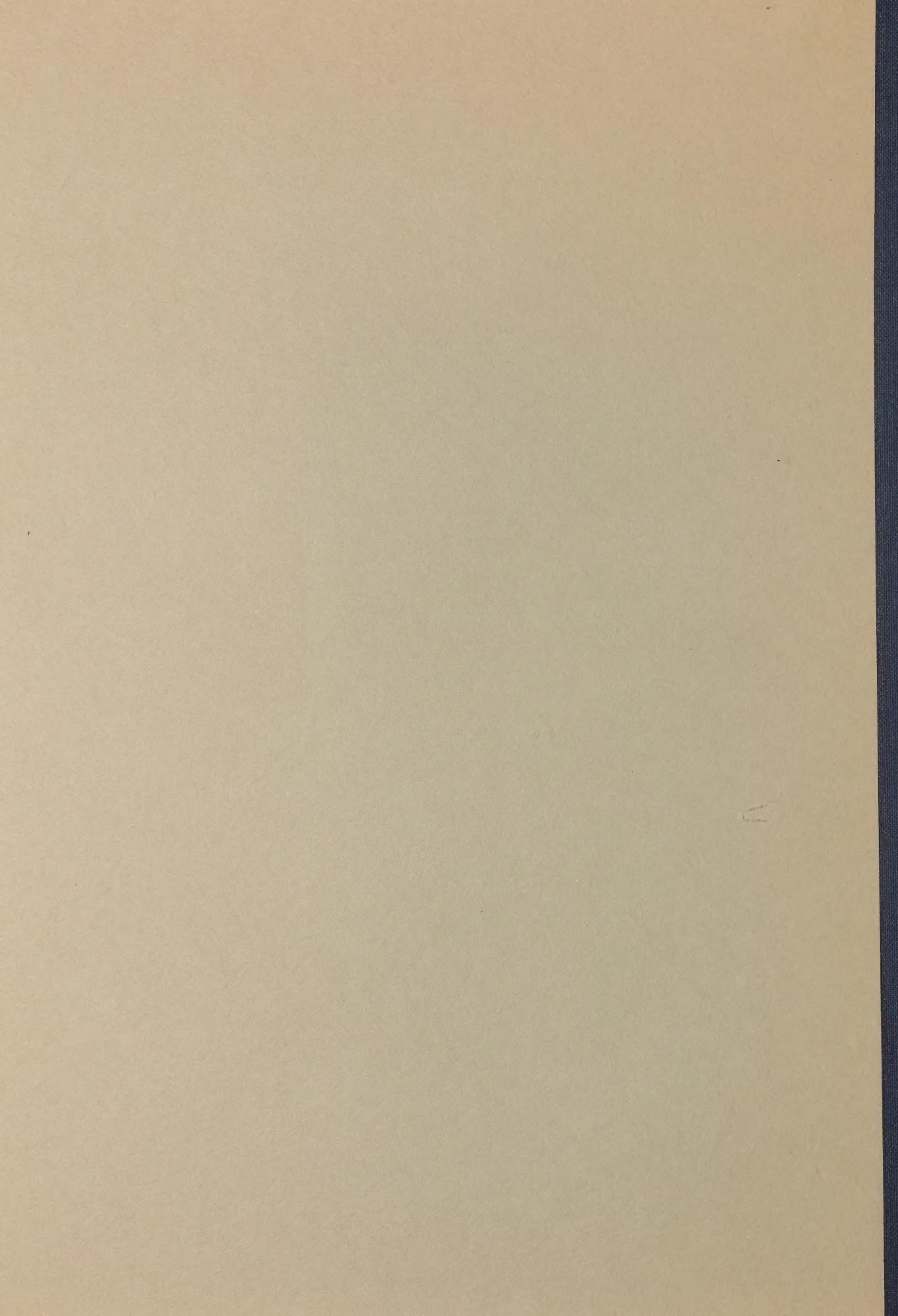
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The journey to work in
the metropolitan area of
Edmonton

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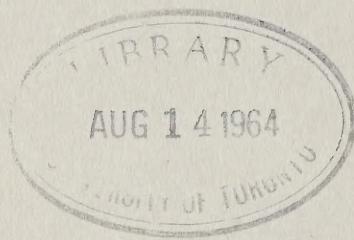


THE JOURNEY TO WORK

in the

METROPOLITAN AREA OF EDMONTON

Edmonton District Planning Commission
April, 1953



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THE "JOURNEY TO WORK" IN THE METROPOLITAN AREA OF EDMONTON.

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FORWARD

The industrial survey of the Edmonton metropolitan area was launched by the Commission at its meeting of August 28, 1951. The general purpose enunciated was "to discover the basic industrial activities that support the Edmonton area and to obtain information that will be a guide in determining future industrial land and locational requirements."

Field work began in September, 1951 and continued, intermittently, until June, 1952. In the course of that time some 1400 firms were presented with survey questionnaires. Special thanks is due to the many proprietors and managers of firms who gave survey workers an opportunity to explain the objectives of the survey through personal interview; and to the Edmonton Chamber of Commerce which undertook, by discussion and circular, to explain the purposes of the survey to its members.

Analysis of the returns commenced in June, 1952. The report which follows analyses only one part of the stock of information built up through the survey. Its aim is to present, in an intelligible form, the facts of the distribution of employee residences in relation to workplaces, and the causes of the discovered tendencies. It seeks, in this way, to provide reliable guideposts for coordinating the locations of industry and housing in the interests of proprietor and worker, and of general traffic efficiency. To the extent that its method is sound, the analysis presents the possibility of establishing a scientific basis for a limited, but significant aspect of planning policy - which otherwise might be necessarily guided by mere opinion, preconception or even prejudice.

The report, in its present form has had the benefit of constructive criticism by Mr. Noel B. Dant, Town Planner, City of Edmonton and Mr. H. N. Lash, Director of Town and Rural Planning. It is hoped that the material presented will command serious study and be used as an instrument for effective planning.

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1) Statement of Purpose

It is strange but true that although the city, as we know it, has come into existence for the production and/or distribution of goods - it becomes, as it grows, a fetter on these activities. The industrial civilization of the past half century has displayed two contrary and conflicting tendencies: while the individual plant, through technical advance and good organization, has become more efficient, the environment in which it operates, the urban community, has become less efficient. To a significant extent, the internal economies of the firm have been offset by the external wastes of the city.

The inefficiency of the city has its roots in an improper relation between places of residence and places of work, and between the various industries within its area - that is, in the disorder of what is called the "functional structure" of the city. The disorder appears to us amongst other things, as inconvenience and congestion in traffic. The traffic network, which is to the city what the arteries of the blood stream are to the human body, has become clogged, causing the waste of much time, money and energy.

First results of the Industrial Survey of the Edmonton metropolitan area give us the opportunity to closely examine a critical part of the functional structure, that is the home-work relationship - the way in which the location of work place determines the location of employee residence. The aim will be -

- (1) to expose the existing home-work pattern,
- (2) to discover the forces which create the existing pattern, and
- (3) through the understanding derived from (1) and (2) to seek the means of minimizing the wastes of excessive distances between home and work, whenever they may exist.

In pursuing this analysis, we are highly conscious of our unique opportunity in Edmonton, which is still at the primary stage of a petro-chemical industrial development, of learning from the experience of the more mature industrial centres, and of avoiding their costly errors.

2) The Home-Work Relationship.

Distance from place of residence to place of employment affects the interests of the worker, the industrialist and the community in different, but inter-related ways. For the employee, the issue of leisure time and the avoidance of the fatigue of excessive daily travel is involved. The industrialist is interested in the effect of commuting distance on labour efficiency; production costs may be directly affected by the demand for portal-to-portal pay, which frequently arises where total travelling time exceeds one hour. Travel to work has a far-reaching effect on the life of the community because it is the major generator of traffic; the large number of daily trips, the low average car occupancy for work trips, the concentration of such travel at morning and late afternoon peaks - these things combined, make work travel, and indirectly the home-work relation, the most crucial factor in urban traffic. All these interests - that of the worker, the employer and the community - merge, in this case, into one general planning interest in improving the quality of local life. This general interest will be served by that distribution of employees in relation to work places which minimizes the total daily distance travelled to work. The extent to which this ideal is approached locally will become evident in our analysis of the employee distribution maps of the fourteen industrial areas of Edmonton, based on returns from 861 firms, including wholesale businesses, employing 11,842 workers. In addition returns were received from the Canadian National, Canadian Pacific and Northern Alberta Railway Companies, representing in all 2,443 employees,

and reference will be made to these when they either confirm or contradict the home-work pattern of the 14 industrial areas.

As an aid in the analysis, a number of tables have been prepared containing information which will enable us to assess the importance of various factors underlying the observed home-work patterns. The titles of the tables and their general purpose are as follows:

Table 1) Residential Cluster Tendency of Industrial and Wholesale Employees, Edmonton Area - An aid in the interpretation of the Home-Work Maps.

The following data is presented:

- The number of employees represented by survey returns in each industrial area.

- The per cent of total employees covered by the survey in each industrial area.

- The distribution of employee residences by quarter mile zones from the geographical centre of each industrial area, and the cumulative percentage up to $1\frac{1}{4}$ miles; this indicates the "cluster tendency".

- The per cent of employees of each area who live across the river from their place of employment.

Table 2) Housing Demand Generated By Industrial Areas in Metropolitan

Edmonton: - Shows the income scale of employees in each industrial area and its meaning in terms of the housing they can afford.

This will help to assess the income-housing factor in the residential distribution of employees; that is, the way in which workers follow their economic capacity in their choice of housing accommodation, quite apart from consideration of distance from work.

Table 3) Age Factor, Industrial Areas - Per Cent Distribution of Employees

By Term of Employment - reveals the comparative age of each industrial area.

The information is an aid in evaluating the age factor, the way in which percentage of employee cluster of each industrial area is affected by the maximum number of years such employees could have worked in each of the fourteen industrial areas - that is, by the number of years they have had to adjust home to work.

Table 4) The Demand For Low Rental Accommodation By Industrial Employees and Major Localities of Low Rental Supply.

This table demonstrates the extent to which the lowest income group amongst industrial employees select the few areas within the metropolitan limits where they can find accommodation within their means.

3) Employee Distribution - City of Edmonton.

Circles have been drawn on the accompanying industrial area maps from the centre of each industrial area at quarter-mile intervals to provide a means of comparing the degree of employee residential cluster in each area. The results are indicated in Table 1. All reveal considerable grouping about the work place, but there are some important variations. On the north side of the river, the general tendency is for cluster to increase from west to east, from outlying to near central, to a peak in Industrial Area No. 5, which straddles the C.N.R., cutting diagonally across the eastern part of the city. From this peak, cluster sharply declines from the central industrial areas, Nos. 6, 7 and 8 to the westermost area, Number 9, adjacent to the C.N.R. railhead. On the south of the river, the two central industrial areas exhibit a tendency for close-in employee concentration second only to peak area No. 5.

Industrial Areas 1, 2, 3

Industrial Areas 1, 2 and 3 along the northern Canadian National Railway line show a relatively low degree of cluster, (See Home-Work Maps 1, 2 and 3). The common cause of this is the isolation of the areas,

particularly 1 and 2, from housing development. "One of the major difficulties at this time," reports the proprietor of a foundry employing 37 men, "is that the distance employees have to travel to procure suitable accommodation creates hardship and a public health hazard." This statement suggests that if the right kind of housing was available close in, it would be preferred over more dispersed accommodation. The "right kind of housing" is suggested by the figures of Table 2, which indicate that 27.9%, 29.6% and 33.7% of the employees in areas 1, 2 and 3 respectively require accommodation at rentals below \$41 per month; and 56.1%, and 54.4% and 45.8% between \$41 and \$62. The only considerable close-in low-cost supply for industrial groups 1 and 2 is in the Calder area outlined in Map 1. As the railway maps indicate, that locality has been previously taken up by employees from Northern Alberta Railways and C.N.R. yards, which flank Calder west and east, and to a considerable extent by employees of the C.N.R. South Yard who have quite convenient access via 124th and 127th Street bus routes. (See Transit Map). The comparative age of these centres of employment bidding for Calder space is a factor here. As is evident from Table 3 only a relatively small proportion of employees in areas 1 and 2 (35.6% taken together) are in industries established before 1940; whereas the railway groups are pre-1940. Their employees have had more time to adjust distances between home and work. Consequently, we find a larger proportion living close to work, than in areas 1 and 2:- 37.2% within the $1\frac{1}{4}$ mile zone of the 420 N.A.R. employees and 33.2% of the 1066 Calder Yard employees. The greater cluster tendency of railway yard employees is due, as well, to the nature of some of the work performed, such as that of switchmen and other trainmen, who work the year round on periodic night shifts at the "mercy" of the call boy and would find great distance from place of work extremely inconvenient. Unable to find housing within their means in the Calder neigh-

borhood, employees of areas 1 and 2 have sought other low-cost areas, mainly the central area about $3\frac{1}{2}$ miles distant, a considerable number in Jasper Place, and some even as far as Beverly, over $5\frac{1}{2}$ miles away. The result, as indicated in Table 4 is a very high correlation between the proportions with incomes below \$2000 and the proportions in the low-cost, high-density areas; 27.9% and 29.7% in industrial area 1, and 29.6% below \$2000 and 26.8% in low-cost, high-density localities in industrial area #2.

The greater degree of cluster in industrial area 3 (compared with 1 and 2) testifies to the importance of suitable close-in residential areas - particularly low-cost areas. The group at the base of the income pyramid have, by virtue of limited means, less freedom of choice, and therefore can be expected to gravitate very definitely towards the housing they can afford. Where, therefore, one or other of the low-cost areas (listed in Table 4) fall within the $1\frac{1}{4}$ mile zone of an industrial area, the cluster tendency in that area will be quite pronounced. Although none of the major low-cost areas are within the $1\frac{1}{4}$ mile zone, it does contain parts of Residential Areas 1 and 2 which contain a cross-section of housing types with a bias towards low cost (see Map 4). The taking up of this close-in housing capacity by Area 3 employees explains the discrepancy between the demand for low-cost housing (33.7% require housing below \$41. a month) and the actual use of the available concentrations of low-cost accommodation (only 18.5% of the working force live in the major low-cost, high-density areas.) (See Table 4)

Industrial Area 4

Industrial area 4 reveals the effect of the "age" and "income-housing" factors. The pattern revealed on the map reflects to a great extent the influence of the large, long-established meat packing and lumber firms, some of which date from World War 1. About 86% of the employees are in industries established before 1940; the home-work relation is a mature one. Adjustment

of home to work over the years has resulted in 38.5% of the employees finding the residence within the $1\frac{1}{4}$ mile zone - the second greatest percentage of cluster on the north side of the river. This implies a considerable adjustment of housing supply to housing demand. Almost 7% of the 1456 employees live in North Edmonton (Fig. 1) which falls within $1\frac{1}{4}$ mile zone; while the other close-in employees have found accommodation in the mixed Income Areas 2 and 7. (See Map 4). The income-housing factor works, as well, as a dispersive influence. Table 4 indicates a very close relation between the demand for low-cost housing - the most specialized of all housing demand - and the filling in of the major low-cost localities by Area 4 employees. Some have found what they need in the central area, conveniently connected by bus routes 7, 5, 2 and 9: but others have had to go further afield - to Beverly, with which there is no direct transit contact, and to Jasper Place, on the other extremity of the built-up area about 5 miles distant. The natural desire to minimize travel time, distance and inconvenience has not, in this case, been sufficient to overcome the movement away from work towards appropriate housing. These factors, however, have had an effect on the distribution of the group at the top of the income scale, the 2.8% with incomes over \$5000. who can afford houses costing \$12,500. and up; the home-work distribution reveals a marked preference for the close-in Highlands area (in which 16 live) over the other two far-out, top-quality neighborhoods of Glenora-Capitol Hill and Windsor Park (in which 3 find residence).

Industrial Area 5

The home-work relation of Industrial Area 5, where the cluster tendency reaches a peak of 54% within the $1\frac{1}{4}$ mile zone, reflects an intensification of the same factors which operate in Area 4. Even a larger percentage of these employees, 87%, work in industries established before 1940. And a very large proportion of the specialized low-income housing

demand (about 63% of that demand and 18.7% of the total working force in Area 5) find accommodation in the Central high-density, low-cost locality which falls within the Area's $1\frac{1}{4}$ mile zone. (See Table 4). The cluster tendency is strong, as expected.

Industrial Area 6 & 7

Employees of the Central Industrial Areas, 6 and 7, show considerably less inclination to group about their work than those of Area 5, just a little to the north and east. The data of Table 3 indicate that this may be due to the fact that there are somewhat fewer older industries, and that, therefore, the natural tendency to minimize home-work separation has not yet fully emerged. To some extent the sharp drop in cluster tendency may be due to the sheer concentration of employment in 6 and 7; their combined industrial and wholesale employment of 5893 is the largest concentration in the metropolitan area (Table 1); it is obviously more difficult for say, fifty per cent of these employees to find close-in accommodation than it is for the 3436 employees in Area 5. Both these factors explain the picture in part, but only in part. About three-quarters of the employees in Areas 6 and 7 are industries established before 1940 - enough to produce a considerable cluster in response to basic forces. That there is a scarcity of close-in housing in relation to demand is suggested by the data of Table 4. For example, a considerable part of the low-income demand has been met in each case within the $1\frac{1}{4}$ mile zone - in the Central area, 243 employees or 43% of the group below \$2000. of Area 6 have found accommodation, and 353 or 26% of the low income group in Area 7. But, as is evident from the homework maps and from Table 4, many of this group with every special housing needs (436 altogether) had to go much further afield - to Calder, North Edmonton, Beverly and Jasper Place, seeming to indicate that suitable housing was just not available close-in.

"Due to high costs of central rents," reports a Tent and Awning firm at 100th Avenue and 102nd Street, "our staff is continually changing address to find suitable low-cost rental." Here we have a highly articulate expression of the pressure of central employees on available close-in low rental accommodation. This pressure is reflected in the high densities of the Central area and the Triangle, which have a typical range of 61 to 120 percent per net residential acre in the first and 41 to 80 in the second, compared with the usual local range of 25 to 30 per net residential acre. The saturation points seem to have been reached.

Without minimizing the unbalance between localized housing supply and demand as one of the factors which determine the home-work relation of Areas 6 and 7, there is some evidence that it may not, after all, be the dominant factor. Table 1 shows no consistent inverse relationship between the volume of employment and the degree of cluster; the areas of small volume are not invariably the areas of great cluster and vice versa. What may be the basic cause of the discovered employee distribution is suggested in the comment of a marble and tile firm at Jasper Avenue and 91st Street, with an employment of 70: "The number we employ", reports the proprietor, "fluctuates quite a bit depending upon the volume of current construction, wage scale, scarcity of tradesmen, etc."

Considering one of the basic principles governing the location of economic activities in urban areas, the tile company's choice of a central location cannot be considered an accident - it is related, in part at least, to its peculiar labor needs. Past experience in other cities which have been carefully studied indicates that the activities which move towards the centre are those which are most dependent on accessibility of materials and/or labor - particularly where the transportation system is radial as in Edmonton that is, along lines diverging from the centre to the periphery. At the centre the costs of moving materials and/or labor are minimized. An industry

characterized by fluctuating business and labor supply, such as marble and tile, seeks a central site because that is where it can expand or contract its labor force with minimum cost and inconvenience. High labor turnover predisposes the firm to locate at a point of maximum accessibility to the total labor supply and labor at a point of maximum accessibility to all firms, but not to any particular one. The worker has little incentive to live near the spot of temporary employment. Place of work does not exert a pull on place of residence.

To the extent that there are in Areas 6 and 7, firms in which employment, for seasonal or other reasons, is unsteady, the cluster tendency will be less. Thus the home-work pattern of hatcheries and poultry marketers, garment manufacture, furniture, construction and supply and other seasonal industries within these Areas determine, in part, the dispersive tendency in the general home-work relation. But this is not the whole story. Because Areas 6 and 7 are at the focus of radial transportation system, they can be reached from all directions by means of a few well-serviced, cross-town bus routes. This is reflected in employee distribution beyond the $1\frac{1}{4}$ mile zones. The home-work maps reveal a striking concentration along main transit lines - along Jasper Avenue (Routes 2, 5 and 7), 124th Street (5), 101st Street (1) Jasper Avenue and 124th Street for Area 7. A similar grouping along transit lines may be observed on the south side. Since this factor, the central position of Areas 6 and 7, with regard to the transportation network, affects all constituent industries alike, it must be considered the major cause of the sharp decline in cluster from the peak of Area 5. The strength of this factor is indicated in the home-work map for the central C.N.R. employees. The cumulative percentage of cluster for the employees of this stable, long-established industry is at 33.8% (589 of 1740 in that $1\frac{1}{4}$ mile zone)

virtually the same as that of Area 6.

Industrial Area 8

The position of Area 8 near the geographical centre of the built-up area and near the focal point of the transit system suggests that its cluster will be relatively low. But by the same token it would not be expected that its cluster would be less than that of Area 7, 20.2% compared with 25.1%. In fact the long shape of the Area suggests that employees of the northern half, furthest from the centre, would tend to minimize home-work distance and so increase the overall cluster tendency of the Area. This expectation, however, is not yet fully evident because such a large proportion of the group north of 111 Avenue, 56% (270 of 482), are employed in firms which have been established for only 2 or 3 years. Other reasons for the unexpectedly low cluster tendency are: (1) the dispersive effect of the "income-housing" factor; 13.8% of the total working force live in the Central low-cost, high-density area and 6% in Jasper Place, both outside the $1\frac{1}{4}$ mile zone, and (2) the large undeveloped areas within the zone of cluster - the Municipal Airport and the area north of 106 Avenue and west of 131st Street.

Industrial Area 9

The cluster of Area 9 employees is due to the sparseness of residential development close in. The Area is some 10 blocks away from the most westerly extension of the built-up area; filling in of the new Westmount neighborhood, just to the east, would undoubtedly increase the percentage of grouping. Employees, however, might be reluctant to move closer because the Area has been re-zoned, the industries are now non-conforming uses, and the railhead on which they are located will, by agreement with the C.N.R., be removed.

Industrial Areas 10 & 11

Home-work maps for Industrial Areas 10 and 11 reveal two seemingly contradictory tendencies - on the one hand, heavy employee concentration within the $1\frac{1}{4}$ mile zone (42.3% and 52.6% respectively), and, on the other, more cross-river dispersion than any of the other industrial areas within the city (26.5% and 29.3%).

The pronounced cluster tendency appears to be due to a combination of inter-acting factors. The Saskatchewan River represents a physchological and actual barrier to cross-river residence of south side employees. One firm, an oil field trucking enterprise at 104th Street and 57th Avenue has reported (with perhaps some exaggeration) that "it is cheaper and more convenient for employees to come from Leduc rather than live on the north side of the City." Only one line, Route 1, of the numerous north side lines, leads directly from residential neighborhoods across the river to the south side (See Transit Map). It is not possible to move from any other north side neighborhood to south side employment without transferring. Service on routes crossing the most westerly and most easterly bridges is, at 20 and 30 minute intervals, slower than the average. These conditions, together with the general tendency (typified by Area 4) of off-centre employees to minimize home-work separation, have created a demand for close-in housing. New neighborhoods within the cluster zones of both areas - such as Parkallen, Parkdale, Bonnie Doon and Richmond Park - provide accommodation within reach of at least those earning from \$3000 to \$5000. per annum, which includes 36% of Area 10 employees and 26.7% of Area 11 employees.

Inasmuch as these conditions apply to both southern industrial areas the higher percentage of in-grouping in Area 11 must be due to the effect of differences in some of the other determining factors. The figures of Table 3 suggest that the age factor is an influence here - only 25% of Area 10

employees are in industries established before 1940, compared with 67.3% for 11. And the figures of Table 2 show that a significantly larger proportion of Area 10 employees are in the income group, over \$4000, which can best afford an automobile - 17.2% compared with 10.3. Both these prejudice the Area 10 distribution towards greater dispersion than Area 11.

The striking characteristic of Area 10 distribution, however, is the high degree of cluster (3rd highest in the metropolitan area) in spite of the fact that such a large proportion of workers, about 41%, have not been employed in Area 10 firms for longer than one term of house occupancy. This is to be explained by two special circumstances. Eight firms have complained about the lack of bus service on 104th Street, the main north-south artery cutting through the area. The comment of a sheet metal enterprise at 104th Street and 72nd Avenue is typical:

"Transportation (Edmonton Transit System) is terrible for this area. An estimated 1000 men work south of this establishment and no bus service is supplied. We would like service during mornings and evenings".

Significantly, all of the eight complaining firms are located south of 76th Avenue where Route 12 turns west for 3 blocks before continuing southwards. (See Transit Map) And significantly the cluster for these is greater than for the Area 10 group as a whole - 51% instead of 42.3%. The necessity to walk several blocks from the terminus of bus route 12 requires the saving of travelling time on the bus and hence closer-in residences. It does not follow, however, that the extension of Route 12 southwards along 104 Street will necessarily decrease the cluster tendency.

The second circumstance behind the Area 10 close cluster arises from a peculiar condition of industries serving the oil fields, namely the irregularity of working hours which makes employees subject to 24-hour call at short notice.

The man awakened in the middle of the night and asked to report in 30 minutes (or to be ready for pick up by truck) naturally wants to live close to head office (or head office close to him). There is, in addition, a somewhat accidental circumstance which reinforces this natural tendency. Because of the irregularity of working hours the oil field industry attracts a high proportion of single men (for example, 63% compared with 52% for Area 11 on the other side of the tracks). These can find the rooming-house accommodation they need nearby in an area which for many years has served University students - the area north of University Avenue between 104th and 112th Streets. The home-work map shows a heavy concentration in that area.

The other observed employee distribution tendency - the unusually high cross-river dispersion of south side employees - reflects the attractive force of the city centre, with its concentration of the best shopping facilities, restaurants, theatres, library and taverns.

4) Employee Distribution. Outer Industrial Areas

The position of Strathcona, Beverly and Jasper Place industrial groupings on the edge of the built-up area does not permit analysis of employee distribution by the method used for City groupings. Comparison of cluster tendency by quarter-mile zones would not be valid because such large parts of the fringe zones would cover open country. A more general descriptive approach will be used.

Industrial Area 12

Area 12's home-work relation cannot be considered a stable, mature one because there is no close-in residential accommodation and because it has developed so recently - within the last few years. The distribution shows a slight preference of those within urban limits for the south side, 283 of 600 or 53%, where there is more direct access to the highways, 16 and 14, leading to

the industries. Many of these are in the residential areas which grew up simultaneously with Area 12 industries - Strathearn Heights, Parkallen, Beau Park, Riverview Heights, etc. North side employees show a distinct grouping close to cross-river bridges and along major thoroughfares; most striking is the line of employees following 124th Street where 53 or 18.7% of the north side group reside.

Industrial Area 13

The employee distribution of Area 13 is a relatively mature one reflecting many years of opportunity to adjust home to work. Dominion Tar and Chemical was established in 1925; Beverly Coal in 1931. The relation is typical of a stable off-centre grouping. Forty-eight or 37.5% of the total live in the Town of Beverly; and those beyond are almost entirely east of 97th Street.

Industrial Area 14

Over 43% of Area 14 employees live in the Town of Jasper Place. If one excluded the 72 employees of Parker Drilling, which is not typical of Jasper Place Industry, the percentate would be well over 90. This remarkably high cluster tendency arises primarily out of the relationship between industry and residential accommodation in that locality. Highway 16 is the main entrance to Edmonton of trucks hauling lumber from the western part of the Province. Taking advantage of this convenient source of supply some 7 lumber firms, mainly planing mills, have located on the strip of highway which runs through the Town of Jasper Place. This industry employs unskilled workers at relatively moderate wages, as indicated by Table 2. For a number of reasons, particularly the unregulated manner in which the Jasper Place settlement first arose, the housing available in the town is available at comparatively low cost, within the means of the area's labor

force. Hence the inclination of employees to settle close to place of employment.

5) Home-Work Pattern: Summary and Interpretation.

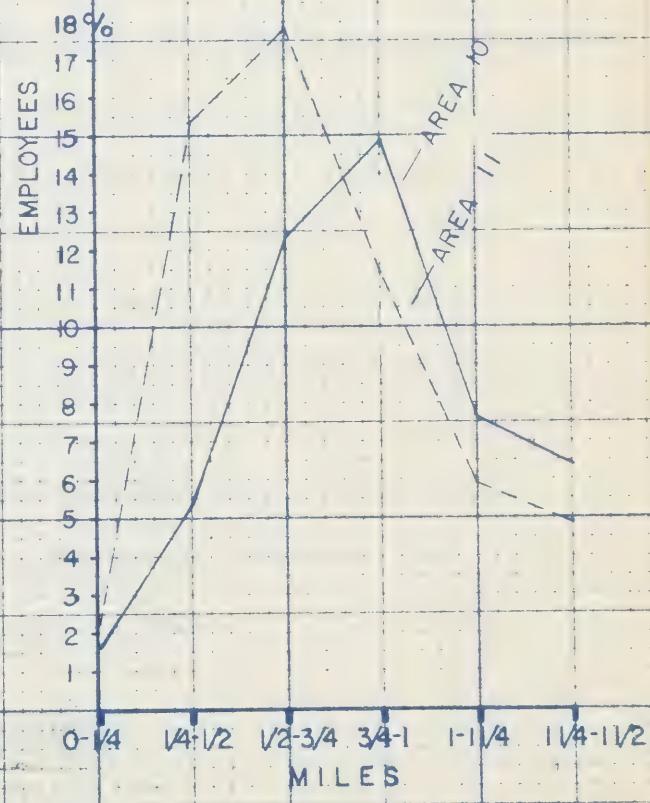
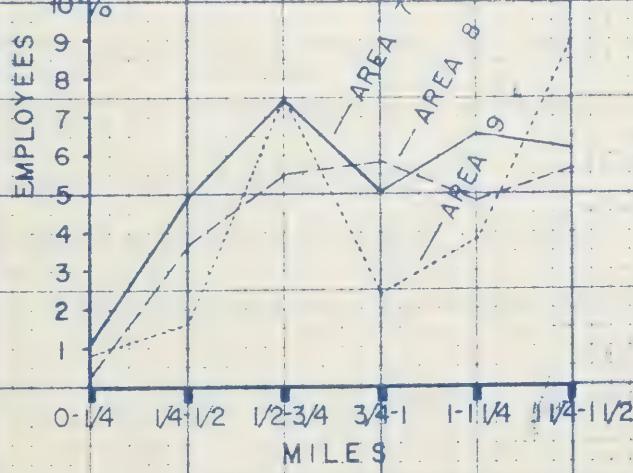
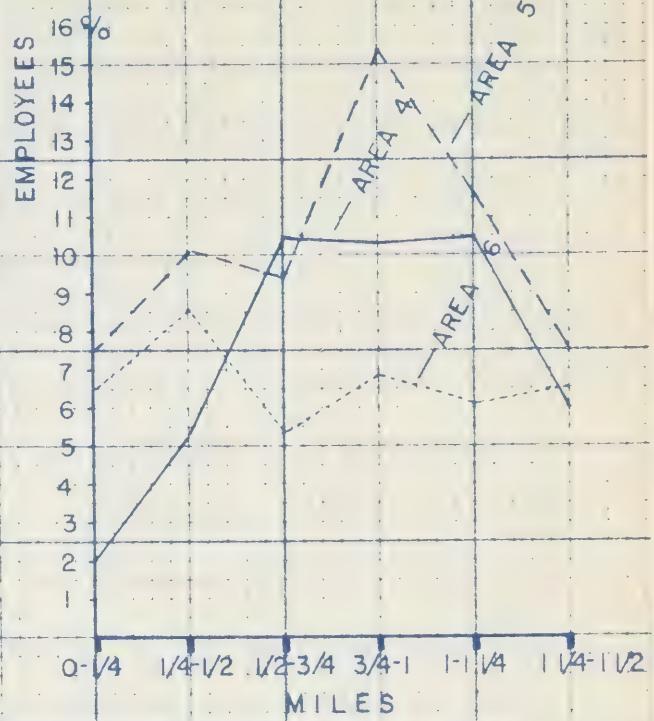
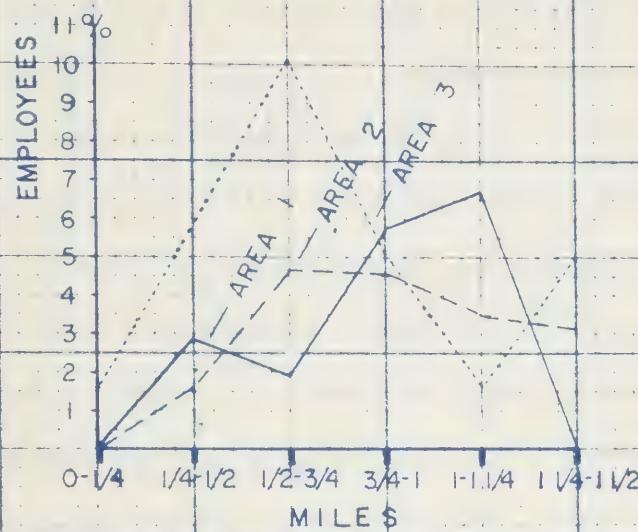
The over-all metropolitan home-work pattern suggests a natural tendency for industrial and wholesale employees to minimize the distance between home and work place. The striking fact which emerges is that cluster is highest in those areas where the income-housing factor is positive, that is, where a considerable part of the moderate wage earners can find housing they can afford close to their place of employment. These are Industrial Areas 4, 5, 10 and 11, all off-centre areas. Graph 1, containing the distribution curves of employee residence by quarter mile zones, reveals a basic similarity in the curves of these areas - a rapid rise to a peak close to the point of origin (within 1 mile from the centre of employment), followed by a steep tapering off as distances from work place are increased. By contrast, the employee distribution curves of the central industrial areas, 6, 7 and 8, are flatter with lower peaks and less amplitude between peaks and lows. This means that central area employees (a) are more evenly spread over the entire city than off-centre employees, and (b) have longer distances to work.

It is interesting to note that the same pattern of home-work relationships was discovered in nine American cities, namely Detroit, Cleveland, Cincinnati, Chicago, Pittsburgh, Washington, Baltimore, Milwaukee and Los Angeles. # This suggests that there are certain underlying forces which can explain the pattern in all these cities, or, for that matter, any city of the North American Type. These forces may be summarized in two basic assumptions (1) that there is a common and consistent need to minimize home-work separation and (2) that the city centre is a major influence on the

J.D. Carroll, "The Relation of Homes To Work Places And The Spatial Pattern of Cities." Social Forces. 1952

GRAPH I

PER CENT DISTRIBUTION OF EMPLOYEE RESIDENCE BY QUARTER MILE ZONES FROM CENTRES OF INDUSTRIAL AREAS IN METROPOLITAN EDMONTON



employee distribution of both central and off-central industrial areas.

Behind the first force is the desire of workers to minimize the annoyances of peak hour travel, and their drive for leisure which arises out of the conditions of an industrial civilization. And behind the second is the impact of the unique shopping, entertainment and cultural facilities of the Centre and of its position as the focal point of the urban transportation network. Assumption (1) explains the significant degree of cluster discovered in all industrial areas which are not isolated from housing and whose employees have had some time to adjust home to work (See Table 1). Assumption (2) explains, on the one hand, the paradox of close-in cluster and sharp tapering off of the non-central employees (towards the attractions of the centre), and, on the other, the characteristically even dispersion and long travelling distances of central area industrial employees. The many specialized functions concentrated at the Centre make it the transportation focus; the major roads lead to it as well as the speediest, most direct bus service from all parts of the built-up area. The time-distance for a man commuting 2 miles from home to Centre is less than the time distance of the man commuting 2 miles to a suburban industry. Hence greater dispersion of central area employees is consistent with the drive for leisure time.

This general theory is, of course, modified or reinforced by the special conditions, such as the nature of certain industries and planning policy, which are peculiar to the Edmonton Area. Insofar as it is an adequate explanation of the observed pattern it gives assurance that the discovered home-work relation is not accidental or temporary, and, therefore, that it is an assumption upon which planning policies can be built.

6) Home-Work Pattern: Guide to Planning Policy.

It can now be stated as a rule of urban development that industrial employees as a group tend naturally to minimize the distance between home and

work. Thus we have a type of group behaviour which minimizes the inconvenience, cost and congestion of work travel - the most crucial part of urban traffic. How can this healthy tendency be encouraged? First, by the creation of neighborhoods in the vicinity of industrial areas which are genuine economic cross-sections, or more specifically, neighborhoods in which the scale of rents and/or housing cost would have a close relation to the income scale of the employees in the closest industrial group. It is assumed, on the evidence of this study, that where a suitable supply of housing is available the cluster tendency will be strongest and home-work distances, cut to a minimum. Conversely, if the need for relating rental scales (or house costs) to wage scales is ignored in civic policy, there will be a gradual building up of the irrational and wasteful traffic movements evident in all the large unplanned cities of this continent.

A guide to the kind of "cross-section neighborhoods" necessary in the Edmonton area today is suggested by the figures of Table 2, which shows the type of housing demand generated by the employees of each of the fourteen industrial areas. For example, a residential neighborhood (of 850 units) developed near the petro-chemical industrial group (Area 12) should ideally contain the following grades of housing:

<u>Units</u>	<u>Rents Per Month</u>	<u>Capital Cost of Houses.</u>
17	\$21-41	
281	42-62	
399	63-83	\$7,500 - 10,000
111	84-104	10,000 - 12,5000
42	104 and over	12,500 and over

The suggested policy of relating rental scales to wage scales could be most effective in the vicinity of off-centre industrial areas,

where the cluster tendency is greatest-particularly near those isolated industrial areas, 1, 2 and 12, about which a stable home-work pattern has not yet emerged.

The second way in which to reduce the inconvenience, cost and congestion of work travel, through planning policy, is to adjust density and other zoning provisions to the varying demands for residential land made by the different industrial areas. Table (1) (Residential Cluster Tendency of Industrial and Wholesale Employees) indicates the total demand for residence arising from each industrial area, the part of that demand accommodated near each industrial area, and the percentage which is scattered beyond the $1\frac{1}{4}$ - mile zones. For example, of the total 5375 men and women employed in the central warehouse area, only 25% live close-in. To reduce some of the existing cross-city traffic (note-cross-river dispersion-22%), residential densities in the vicinity of Area 7 would have to be varied in such a way that the remaining 4031 employees would have a greater opportunity to find close-in accommodation. If, for example, the objective was to bring as many as possible into the 160 acre area between 106th Avenue to 110A Avenue, and 106th Street to 113th Street, an over-all density of 25 persons to the acre would have to be maintained. If the same number were to be housed in some close-in 80 acre area, the density would have to be 50 per acre, and so on. Since residential growth on the basis of detached, single-family houses typically produces a density of no more than 16 to the acre, the need for some form of multiple-family dwelling construction near the Centre is indicated. In this way, by the manipulation of densities and housing types, zoning policy can become an instrument for improving the efficiency of metropolitan traffic patterns.

It is not assumed, in the above example, that it is possible or desireable for all employees to live close to their work. The evidence of this study, however, does show that where housing is available near centres of

employment it will to a large extent be absorbed by workers from those centres. Thus, it is assumed that the right quantity and quality of housing near industry will itself be an inducement to a high percentage of residential cluster about the workplace, say 40% or 50% as in Areas 4 and 11.

Analysis of the distribution of the central areas, 6 and 7, revealed that it is not desireable, from an economic point of view, for certain employees to live close to towk. These are the men and women employed in the fluctuating industries, seasonal or cyclical, which seek a central location because costs of moving materials and labour at the focal point of a radial transportation system are minimized. It was noted that high labor turnover predisposes such a firm to locate at a point of maximum accessibility to the total labor supply and labor at a point of maximum accessibility to all such firms, but not to any particular one. If this analysis is sound, then a catalogue of employment in fluctuating industries will reveal the hard core of long-distance home-work traffic. It may be that the 1750 industrial employees of of Areas 6, 7 and 8 who live across the river from their work could not be induced to live closer to employment, and that roads and bridges must continue to bear the burden of adjusting home to work.

The question now arises whether the traffic generated by those who will always live far from work for any reason whatever, becomes a limiting factor to metropolitan growth. We know the consequences of unlimited urban extension without a proper coordination of home, work and traffice functions. In the Toronto area, for example, 100,000 cars travel between the suburbs and the City employment areas every day - at an average speed of 6 miles per hour. It is reliably reported that "complete traffice stagnation is not very far away." (1)

This, and other experience too familiar to bear repetition, suggests that an important decision faces every growing urban community, and

(1) - (Fred Bodsworth, "Don't Let This Happen To Your City", Maclean's November 15th, 1951)

that is, to determine the maximum distance, measured in miles and a time equivalent, that anyone will be required to travel between home and work. It is interesting to observe the important place given this question by the planners of Copenhagen, Denmark. They write of "the acceptance of communications as the basis of the town structure because the principle will make it possible to keep the "journey to work" within 45 minutes." (2) The application of this principle in other cities would produce different optimum distances between the centre and the outer urban limit, depending upon traffic volume, the design of main roads, and the public transit facilities available. Since the time of travel in urban areas is a function of traffic volume as much as actual distance, the greater the success of co-ordinating the location of home and work in Edmonton, the greater will be the possibility of growth - without a crippling journey to work for those people who cannot or will not live close to their workplace.

(2) - (Steen Eiler Rasmussen: Greater Copenhagen Planning, Copenhagen Regional Planning Committee, Copenhagen, 1952.)

A P P E N D I X

TABLE 1 RESIDENTIAL CLUSTER TENDENCY OF INDUSTRIAL AND WHOLESALE EMPLOYEES - EDMONTON AREA

Industrial Areas	Total Number of Employees Represented	Per Cent of Total Employees in each area	Per Cent Distribution by Distance Zones					Cumulative Percentage	Cross-River Dispersion.
			0- $\frac{1}{4}$ mi.	$\frac{1}{4}$ - $\frac{1}{2}$ mi.	$\frac{1}{2}$ - $\frac{1}{4}$ mi.	$\frac{3}{4}$ -1 mi.	1- $1\frac{1}{4}$ mi.		
1	104	99%	0%	2.8%	1.9%	5.7%	6.7%	17.1%	8.6%
2	901	96	0	1.6	4.7	4.6	3.5	14.4	12.8
3	119	77	1.7	5.9	10.1	5.1	1.7	24.4	11.8
4	1444	58	2	5.3	10.4	10.3	10.5	38.5	6.6
5	436	84	7.5	10.1	9.4	15.4	11.6	54.0	7.5
6	1754	74	6.5	8.6	5.3	6.8	6.1	33.3	14.5
7	4139	77	1.1	4.9	7.4	5.1	6.6	25.1	22.2
8	917	81	.3	3.7	5.5	5.8	4.8	20.2	18.8
9	129	34	.8	1.6	7.5	2.3	3.9	16.1	11.6
10	1050	84	1.7	5.4	12.3	14.9	7.7	42.3	26.5
11	849	84	2.2	15.3	17.8	11.4	5.9	52.6	28.7
12	630	99						47.0	
13	128	100						3.9	
14	117	87						24.8	

SOURCE:- Industrial Survey, Metropolitan Edmonton - June, 1952.

TABLE 2

HOUSING DEMAND GENERATED BY INDUSTRIAL AREAS, METROPOLITAN EDMONTON

Income Group
in DollarsPer Cent Distribution of Employees
by Industrial AreasMonthly
Rental
CapacityOptimum Capital
Cost of House

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
\$500 - 999	2.04%	9.02%	7.02%	4.07%	.7%	2.03%	2.0%	4.0%	0%	1.6%	3.05%	0%	3.01%	5.04%
1000 - 1999	25.5	20.4	26.0	21.4	28.5	30.4	33.0	3	15.5	56.0	14.3	21.8	2	26.5
2000 - 2999	56.1	54.4	45.8	48.7	48.8	42.2	37.5	64.0	2	32.0	39.9	43.8	32.7	66.4
3000 - 3999	15.3	14.1	14.0	16.4	16.6	19.7	18.6	13.5	4.0	27.0	20.6	46.8	3.9	5.04
4000 - 4999	1.2	4.2	3.6	5.9	1.9	3.2	4.5	2.0	4.0	9.0	6.1	12.9	0	0
Over 5000	0	2.1	2.4	2.8	3.5	2.2	4.0	.6	3.2	8.2	4.2	5.	0	Over 104
														12,500 and over

SOURCE: Industrial Survey - Metropolitan Edmonton, June 1952

NOTE:

"Monthly Rental Capacity" is based on the assumption that a family cannot afford to pay more than one quarter of its monthly income for rent.

"Optimum Capital Cost" assumes that a family cannot afford to pay more than two and a half times its annual income for a house.

These assumptions are based on welfare and economic considerations expounded in the following:-

Housing and Community Planning (March 24, 1944) Advisory Committee on Reconstruction, Queen's Printer, Ottawa, 1946, and L.C. Marsh, "The Economics of Low-Rent Housing, Canadian Journal of Economic and Political Science, 1948.

TABLE 3

AGE FACTOR - INDUSTRIAL AREAS, PER CENT DISTRIBUTION
OF EMPLOYEES BY TERM OF EMPLOYMENT

Industrial Areas	Per Cent of Employees in industries of 1940 and earlier	Per Cent of Employees in industries of 1948 and later	Cumulative percent-age of cluster - $1\frac{1}{4}$ mile zone.
1	35.6%	55.8%	17.1%
2	0	32.6	14.4
3	5.0	53.8	24.4
4	86.4	3.4	38.5
5	87.0	11.0	54.0
6	76.7	10.2	33.3
7	74.3	10.3	25.1
8	61.1	29.0	20.2
9	0	4.7	16.1
10	25.6	41.3	42.3
11	67.3	18.5	52.6
12	0	100%	
13	100%	0	
14	0	89.7	

SOURCE: Industrial Survey, Metropolitan Edmonton, June 1952

TABLE 4
THE DEMAND FOR LOW RENTAL ACCOMMODATION OF INDUSTRIAL EMPLOYEES AND MAJOR LOCALITIES OF LOW-RENTAL.
For Employees of the Fourteen
INDUSTRIAL AREAS

	<u>AREAS</u>														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
a) Total No. of Employees	104	901	119	1444	436	1754	4139	917	129	1050	849	630	128	45	
b) Total No. of Employees - rental group below \$41.	29	267	40	377	127	519	1461	179	73	167	215	13	38	23	
c) Per Cent in rental group below \$41.	27.9%	29.6%	33.0%	26.1%	29.2%	29.6%	35.0%	19.5%	56.7%	15.9%	25.3%	2%	29.6%	51.3%	
d) % of total Employees in low cost and/or high density localities:	0%	.7%	.9%	6.0%	2.0%	1.0%	2.0%	.8%	1.0%	2.0%	.4%	.1%	.5%	7.8%	0.0%
- <u>North Edmonton</u>															
- <u>Central (92 St. - 97 St.)</u>	6.0%	10.0	10.9	14.8	18.7	13.8	8.5	13.8	10.1	4.0	8.3	4.6	10.9	5.1	
- <u>Jasper Ave. - 112 Ave.</u>	2.9	3.9	2.0	.7	.2	.7	.9	1.8	4.6	.3	.2	.8	0.	0.	
- <u>Calder</u>															
- <u>Triangle (S. of Jasper Ave. to River</u>	13.4	3.4	2.0	1.9	2.7	6.4	5.4	7.7	3.1	2.8	6.3	1.7	5.8		
- <u>Jasper Place</u>	6.7	7.8	1.7	1.4	2.8	3.8	6.0	18.5	1.8	3.2	2.2	1.7	43.6		
- <u>Beverly</u>	0	1.0	0	2.1	2.4	.9	1.0	1.2	.1	.2	.1	0	37.5	0.	
TOTAL	29.7%	26.8%	18.5%	27.9%	28.4%	22.5%	21.4%	29.3%	43.3%	10.5%	14.7%	14.4%	59.6%	54.5%	
e) Total No. of Employees in above localities	31	240	21	405	119	395	880	273	56	110	128	91	76	64	
f) % of Low Cost and/or High Density Demand Accommodated in selected Areas (or e) as a per cent of (b)	Over 100%	90%	52%	Over 100%	94%	76%	60%	Over 100%	77%	66%	60%	Over 100%	Over 100%	Over 100%	

SOURCE: Industrial Survey - Metropolitan Edmonton, June 1952, because one firm with 72 employees has not reported its income scale.
NOTE: Area 14 total is lower than that reported in Table 1 because one firm with 72 employees has not reported its income scale. This explains the discrepancy between (b) and (e) of Area 14. The area called the "Triangle" although a relatively high density area (typical range 41-80 per net residential acre) does not contain only low-cost housing. It is an area in transition in which many large, single family houses, old but of good quality are being converted into apartments and rooming houses. Thus an increasing number of employees in the lower income groups find accommodation here.

MAIN INDUSTRIAL ACTIVITIES BY INDUSTRIAL AREAS,
METROPOLITAN EDMONTON

Industrial Area 1 - Grain storage
- Lumber

Industrial Area 2 - Machine Shop - aircraft, oilfield equipment.

Industrial Area 3 - Machine Shop - general, cast iron pipe and fittings.

Industrial Area 4 - Meat packing
- Lumber
- Construction and Building Materials.

Industrial Area 5 - Paper Products - envelopes, boxes.

- Beds and Bedding
- Grain Products - cereals, biscuits.
- Machinery - general, farm, oilfield.

Industrial Area 6 - Grain Products - bakeries, brewing, flour and feed.

- Construction and Building Materials.
- Dairy Products.
- Machine Shops - general and City engineering works.
- Laundry and Dry Cleaning.
- Machinery and Equipment - farm, electrical, hardware.
- Food - egg products, hatcheries, soft drinks.
- Sheet Metal.

Industrial Area 7 - Machinery and equipment - auto, farm, hardware, household.

- Dairy Products.
- Printers and Publishers.
- Wholesale Supply - shoes, clothing, dry goods, food products.
- Clothing
- Poultry Products.

Industrial Area 8 - Grain Products - brewery and bakery.

- Engineering - mechanical and structural.
- Wholesale Supply - groceries, bedding, plumbing.

Industrial Area 9 - Petroleum - oilfield exploration, drilling and servicing.

- Laundry and Dry Cleaning.

Industrial Area 10 - Petroleum - oilfield exploration, drilling, servicing and equipping and refinery equipment.
- Construction and Building Materials.

Industrial Area 11 - Construction and Building Materials.
- Meat Packing.
- Petroleum - oilfield servicing and equipping, and refinery equipment.
- Poultry Products.

Industrial Area 12 - Petroleum Refining
- Tank Farms.

Industrial Area 13 - Creosoting.

Industrial Area 14 - Planing Mills
- Welding
- Sheet Metal.

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